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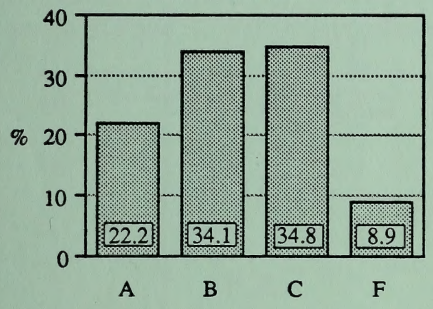
Students First !
EXAMINERS' REPORT
JUNE 1990

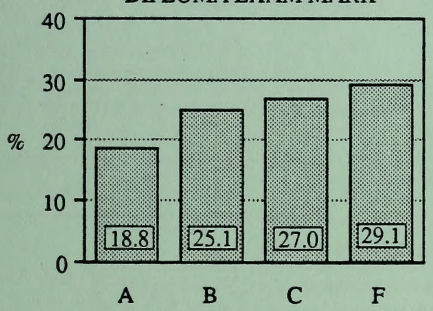
Student Evaluation

Biology 30 Diploma Examination Results

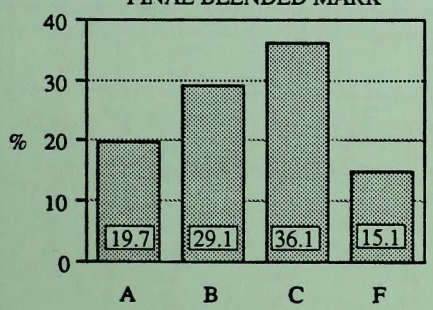
SCHOOL-AWARDED MARK



DIPLOMA EXAM MARK



FINAL BLENDED MARK



The summary information in this report is intended to provide teachers, school administrators, students, and the general public with an overview of results from the June 1990 administration of the Biology 30 Diploma Examination. The information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. The first annual provincial report containing a detailed analysis of the combined January and June results is available this fall.

DESCRIPTION OF THE EXAM

The Biology 30 Diploma Examination consists of two parts: a multiple-choice section of 70 questions worth 70% and a written-response section of seven questions worth 30%.

ACHIEVEMENT OF STANDARDS

The information reported is based on the final blended marks achieved by 10 591 students who wrote the June 1990 examination.

- 84.9% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 19.7% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

PROVINCIAL AVERAGES

- The average school-awarded mark was 67.1%.
- The average diploma exam mark was 61.1%.
- The average final blended mark, representing an equal weighting of the diploma and school marks, was 64.4%.

Alberta EDUCATION

SUBTEST RESULTS

When analysing any detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Machine scored: 46.7 out of 70

Written response: 14.4 out of 30

- Course Content
  - Cellular Processes: 5.7 out of 9
  - Homeostatic Mechanisms: 2.6 out of 4
  - Nutrition and Digestion: 8.1 out of 16
  - Body Fluids: 9.4 out of 15
  - Breathing, Gas Exchange, and Transport: 4.6 out of 7
  - Energy Release: 3.7 out of 5
  - The Kidney: 5.6 out of 10
  - Regulation of the Internal Environment: 12.3 out of 20
  - Voluntary Movement and Body Support: 2.5 out of 4
  - Human Reproduction: 6.4 out of 10
- Process Skills: 22.2 out of 39
  - Multiple-choice questions 2, 3, 8, 9, 11, 13, 15, 24, 26, 30, 31, 36, 38, 40, 42, 44, 54, 63, 68, and 70, and written-response questions 1, 3, 5, and 7.
- Cognitive Levels
  - Knowledge: 16.7 out of 25
  - Comprehension and Application: 33 out of 55
  - Higher Mental Activities: 11.4 out of 20

EXAMINATION BLUEPRINT

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in June 1990 according to these classifications. Numbers with square brackets [ ] indicate written-response questions, and those without brackets indicate multiple-choice questions.

Reporting Category	Questions by Cognitive Level			Examination Emphasis (%)
	Knowledge	Comprehension and Application	Higher Mental Activities	
Cellular Processes	1, 4	2, 3, 5, 6, 7	8, 9	9
Homeostatic Mechanisms	10	11, 12	13	4
Nutrition and Digestion	14, 16, 17, 18	15, 19 [1]	[3]	16
Body Fluids	20, 21, 22, 23, 28	24, 25, 27, 29, 30, 31 [4]	26	15
Breathing, Gas Exchange, and Transport	32	33, 34, 35, 37, 38	36	7
Energy Release	39	41, 42, 43	40	5
The Kidney	45, 46	44, 47	[5]	10
Regulation of the Internal Environment	48, 51, 53, 55, 58	49, 50, 52, 54, 56, 57, 59 [2], [6]		20
Voluntary Movement and Body Support	61	60, 62	63	4
Human Reproduction	64, 65, 67	66, 68, 69 [7]	70	10
Examination Emphasis (%)	25	55	20	100

RESULTS and EXAMINERS' COMMENTS

The examination has a balance of question types and difficulties and is designed so that a student capable of achieving the acceptable standard would obtain a mark of 50% or better on the examination. Students achieving the standard of excellence would obtain a mark of 80% or better on the examination. Despite the parallel structure of this examination to previous examinations, more students than expected (29.1%) failed to achieve the acceptable level. Future examinations will require students to demonstrate clarity in their thinking as well as a higher level of thinking on a broader range of goals. Students will need to achieve these learner expectations if they are to be successful on the examination. For information concerning the 1990-91 diploma examinations, please consult the 1990-91 Mathematics and Sciences bulletin.

MULTIPLE CHOICE

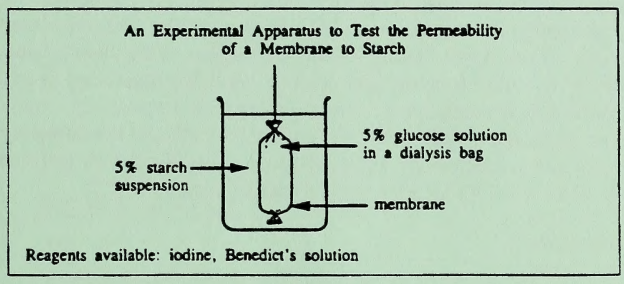
QUES.	KEY	DIFF.*	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.
1	C	76.8	15	B	82.3	29	A	60.7	43	B	58.6	57	A	64.5
2	A	59.6	16	A	61.8	30	D	49.5	44	C	72.8	58	D	69.7
3	B	73.7	17	A	61.5	31	B	52.7	45	B	73.4	59	A	79.3
4	A	73.6	18	D	62.0	32	C	65.3	46	C	39.6	60	D	69.3
5	B	59.9	19	D	77.3	33	D	58.1	47	C	47.2	61	A	72.8
6	B	40.9	20	C	80.9	34	B	70.1	48	B	73.8	62	D	62.0
7	D	61.6	21	B	77.7	35	C	68.5	49	A	77.1	63	B	50.3
8	A	65.7	22	C	66.6	36	B	72.9	50	B	78.6	64	D	48.1
9	D	57.5	23	A	60.9	37	C	73.4	51	A	44.9	65	B	54.5
10	D	71.1	24	A	68.1	38	A	50.4	52	D	63.3	66	B	77.0
11	B	60.7	25	B	68.9	39	D	74.3	53	B	76.2	67	C	78.3
12	D	60.3	26	D	72.9	40	A	85.2	54	B	60.4	68	A	76.1
13	C	71.0	27	B	68.8	41	C	84.1	55	D	72.1	69	C	64.1
14	D	66.3	28	D	65.3	42	C	71.0	56	C	67.0	70	D	84.2

*Difficulty – percentage of students answering the question correctly

MULTIPLE CHOICE (continued)

Students who achieved the acceptable standard demonstrated an understanding of key biological terms (questions 4, 10, and 44) and of the basic functions of human anatomical structures (questions 1 and 20). As well, this group of students matched physiological functions with diagrammatic representations of human structures (questions 19, 34, and 66) and interpreted simple graphs and data tables that correspond directly to the basic core concepts (questions 13, 15, and 68).

Students who achieved the standard of excellence demonstrated the ability to follow multistep processes and to use specialized vocabulary (questions 2, 5, 38, and 47). They applied core concepts to new situations (question 33) and interpreted complex sets of data (questions 31, 38, and 63). Detailed comments on questions 3 and 31, which required students to use process skills, follow.



3. To determine if the membrane is permeable to starch, a sample should be taken from the

A. beaker and tested with iodine
*B. dialysis bag and tested with iodine
C. beaker and tested with Benedict's solution
D. dialysis bag and tested with Benedict's solution

Question 3 required students to select an appropriate procedure to investigate membrane permeability. Students had to recall their knowledge of tests for identifying glucose and starch. Approximately 74% of the students selected the correct solution and test reagent to be used. All students should have been able to eliminate alternatives A and C since testing the solution in the beaker would not have established that starch had passed through the membrane; 11% and 6% of the students chose alternatives A and C respectively. Alternative D, which 10% of the students selected, presented the correct solution for testing but identified an incorrect reagent.

Data Obtained from Four Patients Who Have Circulatory Problems

Patient	% Saturation of Hemoglobin with O_2 (arterial blood)	Cardiac Output (L/min)	Hemoglobin Content of Blood (g/L)	Heart Rate at Rest (beats/min)
I	80	5.5	186	71
II	52	5.5	148	80
III	88	3.0	152	112
IV	91	6.5	119	105
NORMAL	90	5.0	160	72

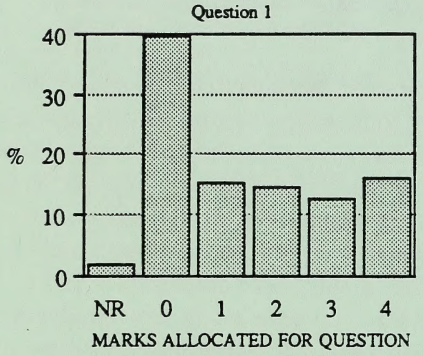
31. Which patient has been exposed to a chemical that is competing for the bonding sites of hemoglobin?

A. I
*B. II
C. III
D. IV

Question 31 required students to analyse a complex data chart and select from it information that corresponded to the health problem described. A clear understanding of competitive inhibition as it applies to the role of hemoglobin was needed. Determining the significant data and thereby selecting the correct patient presented a challenge to all students. Approximately 53% of the students selected the correct answer. A large portion of the students (33%) confused the hemoglobin content of blood with the capacity of hemoglobin to bind with O_2. Of these students, approximately 7% selected patient I, who had the highest hemoglobin content; and 26% selected patient IV, who had the lowest hemoglobin content. Another 15% of the students associated the problem with low cardiac output and therefore selected patient III.

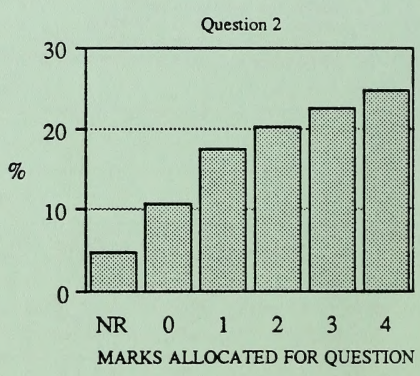
WRITTEN RESPONSE

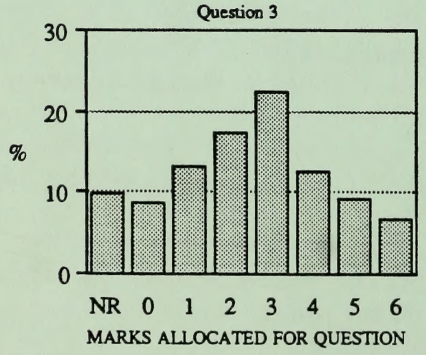
The seven questions in the written-response section were designed to measure achievement on seven of the 10 content strands for Biology 30. All of the questions went beyond measuring simple recall of information. Questions 1, 3, 5, and 7 emphasized process skills and question 3 included two marks for written communication skills. Students performing at the acceptable standard were expected to answer correctly portions of each question. Students performing at the standard of excellence were expected to obtain full marks on questions 1, 4, and 7 and to obtain two-thirds or more of the marks for each of the other four questions. The written-response average score of 47.7% was approximately 7% lower than was expected, based on initial field-test results.



Question 1: A large percentage of the students who obtained one mark or less misread the summary of the investigation as well as part (a) of the question. These students did not understand the meaning of "product of digestion." Therefore, they focused on the regulation of pH by lipase and bile. The most common answer to part (a) was lipase. Having missed the purpose of the investigation, many students concluded from the data that bile and lipase functioned as acids or bases rather than as an emulsifying agent and an enzyme respectively. Some students' responses also revealed their lack of understanding of the difference among observations, conclusions, and explanations. On this 4-mark question, the average mark was 1.47 for 37% of the available mark.

Question 2: Many students correctly identified parts L and M, and most students presented reasonable predictions. Providing explanations for their predictions proved to be more difficult. A small number of students presented sophisticated explanations that extended beyond the content outlined in the *Program of Studies*. The key accommodated a wide variety of answers. On this 4-mark question, the average mark was 2.2 for 56% of the available mark.

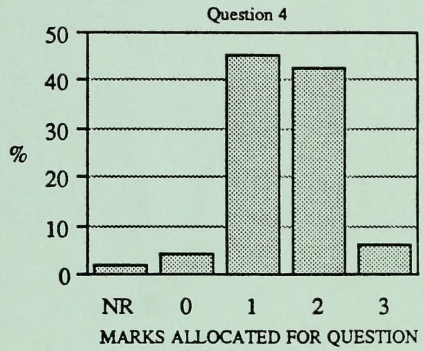


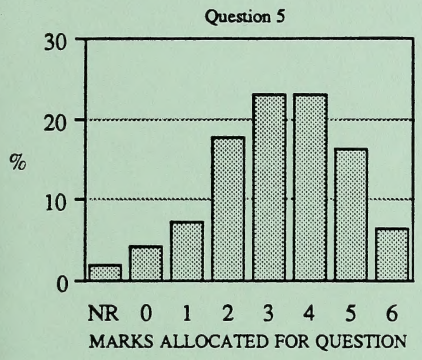


Question 3 generated a wide range of student responses as well as a significant number (10%) of No Responses. Approximately 16% of the students, those who obtained five or six marks, met the challenge of this high level question by composing logical and well-written critiques. These students made effective use of widely accepted information to evaluate objectively the new proposal that grew out of Marshall's preliminary research. On the other hand, some responses revealed the need to address student attitudes toward scientific investigation. Too many students made personal references to Marshall rather than evaluating the quality of his research; they used derogatory terms such as "idiot" and "stupid" rather than scientific vocabulary that identified components of his experimental design. On this 6-mark question, the average mark was 2.52 for 42% of the available mark.

WRITTEN RESPONSE (continued)

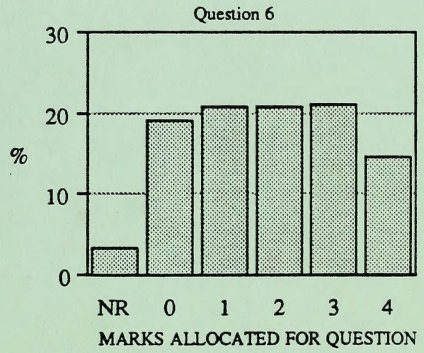
Question 4: Most students described correctly three to six of the nine comparisons and therefore received either 1 or 2 marks. There was little evidence of students following the suggestion to sketch the circulatory system as an aid to forming the required comparisons. The results indicate that the effect of blood from different sources mixing together, thereby altering the level of components by dilution, was a difficult concept. On this 3-mark question, the average mark was 1.49 for 50% of the available mark.

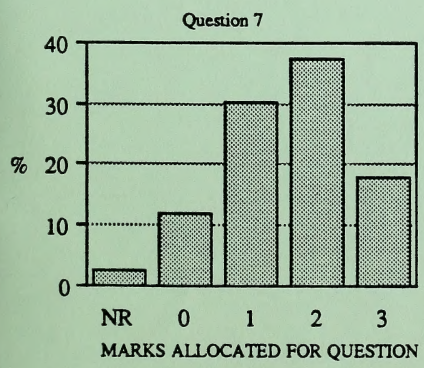




Question 5: Most students demonstrated a good understanding of graph construction. The two most common problems were omitting to title the graph and to label units on the vertical axis. Many students provided good explanations for the changes in glucose concentration, but they often located the process in the wrong portion of the nephron. Few students identified water reabsorption as the reason for the increase in urea concentration. Specialized terms such as reabsorption and secretion were used carelessly; the words urea and urine were used synonymously. Although 71% of the students selected the correct definition of homeostasis in question 10 of the multiple-choice section, very few students could adequately apply this concept to glucose or urea concentrations of the blood. On this 6-mark question, the average mark was 3.24 for 54% of the available mark.

Question 6: Had students read the information in the preamble carefully, they would not have confused the effects of amphetamines with those of anabolic steroids. Students would then have focused more directly on the regulation of internal organs by the autonomic nervous system rather than on the alteration of metabolic activities or mass of skeletal muscles. Many students who answered part (a) incorrectly still obtained marks for part (b) or (c). The key accommodated a wide range of responses to part (b). Behavioral responses, such as drinking large amounts of water, were not accepted for part (c). On this 4-mark question, the average mark was 1.85 for 46% of the available mark.





Question 7: Most students presented correct predictions for parts (a) and (b). However, the explanations given in support of the predictions were often weak. Responses to part (c) indicated that many students think the accessory glands (prostate, seminal vesicles) secrete sex hormones. Others think that testosterone, which is produced by the testes, is transported by the vasa deferentia. On this 3-mark question, the average mark was 1.58 for 53% of the available mark.

For further information, contact Phill Campbell or Lowell Hackman at the Student Evaluation Branch, 427-2948.